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Direct field modulated microwave absorption in $Ba_{1-x}K_xBiO_3$

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Non linear, field modulated, direct microwave absorption (MA) was studied in the high-T_c copper-free isotropic $Ba_{1-x}K_xBiO_3$ (BaKBiO) powder samples. The microwave determined critical magnetic field gradient and the corresponding depinning current density were compared with the values obtained previously for YBaCuO (YBCO) and BiSrCaCuO (BSCCO).

1. EXPERIMENT

Direct MA measurements high-T_c superconductors (HTS) provide information on the critical field gradient $H^*/\lambda_m = J_c^*$, where λ_m is the length scale of field change in the HTS dictated by its pinning properties and J_c^* is the critical de-pinning current density [1]. Here MA experiments in isotropic, cubic BaKBiO are compared to the MA in layered, copper based HTS. Such a comparison may provide insight on how intrinsic properties place essential limits on pinning energies. For example the superconducting coherence length for BaKBiO is comparatively long [2] and this difference could play significant role in pinning processes.

Powder samples of BaKBiO were prepared using a two step heating method [3].From magnetization measurements the critical temperature was found to be $T_c \approx 30K$ and the transition width was rather broad ($\Delta T_c \approx 14K$, 90-10% criterion). Disc shaped, pressed powder samples (9 mm in diameter, and 1.5 mm thick) were placed at the bottom of a 9.6 GHz microwave cavity which was tuned to resonance. The full nonlinearity of the MA was obtained by directly recording and averaging the reflected microwave power. The applied magnetic field $H(t)$ consisted of the four parts: $H(t) = H_0 + H_s(t) + H_m(t) + H_{mw}(t)$, where H_0 was the static field,$H_s(t)$ a scan field, $H_m(t)$ was a modulation field and $H_{mw}(t)$ was a microwave field. In order to compare the results to earlier measurements performed in YBCO and BSCCO,

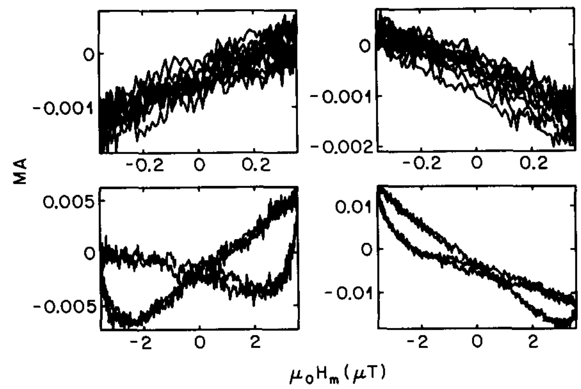

Figure 1. Measured MA vs.modulation field H_m, left for an increasing field scan and right, on the same scale, for a decreasing field scan; at the top, the modulation amplitude was $\mu_0 H_{m0} = 0.36\mu$T and at the bottom, $\mu_0 H_{m0} = 3.6\mu$T.

the field value was chosen in the high-field regime and the experiments were performed in high external fields of H_0/H_{c1}=10, where $\mu_0 H_{c1} \approx 10$mT and at low temperatures $t = T/T_c = 0.14$. Figure 1 shows the MA as a function of the modulation field H_m. The static field was $\mu_0 H_0 = 100mT$, the modulation frequency was $\omega = 2\pi 1000$Hz, and the temperature was 4.2 K. The signal amplitude on the down scan was about twice as large as on the up-scan. The measurements were similar to earlier observations in YBCO and BSCCO although the assymetry between increasing field

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